DOCUMENT RESUME

ED 244 092 CE 038 923

TITLE Learning to Do Math the Automotive Way.
INSTITUTION California State Dept. of Education, Sacramento. Div. of Vocational Education.; California State Univ., Los Angeles. Dept. of Industrial Studies.
PUB DATE [83]
NOTE 56p.; For related documents, see CE 038 922-933. Developed by the Educationally Disadvantaged Committee, Industrial Education InService Project.
AVAILABLE FROM VOICE, California Dept. of Education, 721 Capitol Mall, Sacramento, CA 95814.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Arithmetic; *Auto Mechanics; Behavioral Objectives; Check Lists; *Educationally Disadvantaged; Equipment Utilization; *Estimation (Mathematics); Field Tests; Instructional Materials; Learning Activities; *Mathematics Skills; *Measurement; Measurement Equipment; Ratios (Mathematics); Secondary Education; Shop Curriculum; Skill Development; *Trade and Industrial Education

ABSTRACT

This curriculum guide, one of 15 volumes written for field test use with educationally disadvantaged industrial education students needing additional instruction in the basic skill areas, deals with helping students develop basic mathematics skills while studying auto mechanics. Addressed in the individual units of the guide are the following topics: figuring the cost of gasoline, performing basic arithmetic operations, figuring gear ratios, checking and changing the float level on a carburetor, determining gas mileage, using a micrometer, and making measurements. Each unit contains some or all of the following: a discussion of the major concepts of the technique being covered, instructions to the teacher concerning the use of the given technique, suggested related activities, student instructions, a student assignment, supplemental activities, and one or more worksheets. A basic skills checklist and a basic skills verification form are also provided to assist teachers in identifying those students who require additional help with basic skills. (MN)

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"Learning to do Math the Automotive Way"

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The Educationally Disadvantaged Committee

Industrial Education InService Project

in cooperation with

The California State Department of Education

Office of Vocational Education
Field Operations Section
Industrial Education Unit

and

California State University - Los Angeles
Industrial Studies Department

CE031923

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INTRODUCTION

These instructional techniques were developed for those industrial education students who demonstrate a need for additional instruction in the areas of reading, writing, math, verbal and visual communication. They were written by industrial education teachers with a particular emphasis upon teaching a basic skill while retaining a major focus on the subject areas of auto, woods, metals, electronics, and drafting.

Each of these instructional techniques were written using the same format and with guidance from an expert in the areas of reading, writing, math, verbal and visual communication.

In order to help you identify those students who require additional help with the basic skills, a simple easy-to-use BASIC SKILLS CHECKLIST is provided with each subject area module. This Basic Skills Checklist will enable you as the Industrial Education Teacher to better identify those students in your classes who require additional help in the basic skills.

Additionally, a BASIC SKILLS VERIFICATION FORM is provided which will enable you to ask your school's reading resource teacher, basic skills teacher, math resource teacher, Hart Bill Conferencing teacher, or grade counselors, to verify your identification and provide you with help in the instruction of the basic skills.

You may wish to use these techniques as instruction for your entire class, or as a take-home, parent-involvement assignment. They may also be used in your school's reading or math lab or in conjunction with your school's basic skills instructional programs.

These instructional techniques are successful because your students are able to relate reading, writing, math, verbal and visual communication to their own industrial education classes. When your students succeed, they feel good about themselves, good about their schools, and good about their future.

CONFIDENTIAL

Name _____

Grade ____ Class _____

Date _____

BASIC SKILLS CHECKLIST (AUTOMOTIVE)

The following is a list of the basic skills (reading, writing, math, verbal & visual communication) that the student should demonstrate an ability in for the purpose of employment or advanced training in the automotive trade.

1.0 Verbal Communication: *The student needs additional instruction in verbal communication if any of the items below are checked NO:*

1.1 Yes ____ *The student understands verbal directions or information given by the teacher.*

No ____ *Example: The teacher informs the student that safety glasses are required when using the grinder or wire wheel. Does the student use safety glasses when required?*

1.2 Yes ____ *The student asks questions about instructions or information not understood.*

No ____ *Example: Did the student ask questions about the operation of a particular machine if it appears that he/she does not understand the instructions given?*

1.3 Yes ____ *The student is able to apply information and directions heard to work situations.*

No ____ *Example: After receiving instructions on the proper use of a machine is the student able to have a basic understanding of it's operation?*

1.4 Yes____ *The student is able to verbally communicate with the teacher and other students.*

No ____ *Example: Is the student able to convey instructions/information to other students?*

2.0 Writing: *The student needs additional instruction in writing if any of the items below are checked NO:*

2.1 Yes ___ *The student is able to summarize and write a customer work order.*

No ____ *Example: A customer complains of hard steering; is the student able to convey this problem in writing on the customer work order?*

2.2 Yes____ *The student is able to communicate in writing instructions for a job to be performed.*

No ____ *Example: Is the student able to write a step by step procedure for the correct method of bleeding brakes?*

3.0 Reading: *The student needs additional instruction in reading if any of the items below are checked NO:*

3.1 Yes ____ *The student is able to read and understand job related materials.*

No _____ *Example: Is the student able to read and understand: shop manuals, safety rules, safety warnings (to include the shop safety test).*

3.2 Yes ____ The student is able to follow step by step procedures on an instruction or job sheet.

No ____ Example: Although a student was given a demonstration and a procedure sheet to follow, the student continually gets the operations to be performed out of sequence.

4.0 Math: The student needs additional instruction in math if any of the items below are checked NO:

4.1 Yes ____ The student is able to add, subtract, multiply, and divide decimals to the thousandths place.

No ____ Example: Add: .975 + .129 Subtract: .896 − .143

Multiply: .931 × .612 Divide: .198 ⟌1.345

4.2 Yes ____ The student is able to compute formulas which require the use of decimals, squared numbers, and multiplication.

No ____ Example: $.7854 \times bore^2 \times stroke \times \#\ of\ cylinders$

4.3 Yes ____ The student is able to compute percentages and ratios.

No ____ Example: How much oil should be added to 40 ounces of gasoline to produce a ratio of 20 parts gasoline to 1 part oil?

4.4 Yes ____ The student is able to read a micrometer, ruler, and vernier caliper.

No ____

4.5 Yes ____ The student is able to compute flat rate hours and multiply that number of hours by the pay rate.

No ____ Example: The student works a 40 hour week; however, flat rate hours are computed to be 60 hours multiplied by $10.00 per hour.

5.0 Visual Communication: The student needs additional instruction is visual communication if any of the areas below are checked NO:

5.1 Yes ____ The student can understand working drawings and sketches.

No ____ Example: Can a student understand the proper procedure for the construction of a project simply from viewing a working drawing?

5.2 Yes ____ The student is able to communicate to self and others with simple sketches and/or drawings.

No ____ Example: Is the student able to draw a simple diagram which will remind him/her of the correct position for an engine's vacuum hoses?

IDENTIFICATION MADE BY: _____ Date _____

BASIC SKILLS VERIFICATION FORM

Student _____ Male____ Female____ Grade Level____

Teacher _____ Class_____ Date_____

The Basic Skills Check List (attached) for the above student indicates a need for instructional assistance in the basic skills (reading, writing, math, verbal or visual communication). The following verification and recommendations are made:

____Lacks Reading Skills

____Lacks Writing Skills

____Lacks Mathematical Skills

____Lacks Verbal Communication Skills

____Lacks Visual Communication Skills

METHOD USED FOR VERIFICATION

Recent Test Scores:

Test	Score	Date

Other Verification Methods:

_____

_____

RECOMMENDATIONS

The following instructional assistance is recommended: _____

_____

Verification & Recommendations Made By: _____ Date:_____

Title:_____

_____

_____

FOLLOW UP

Action Taken: _____

Results: ____Qualified for advanced training

____Qualified for employment in the trade

____Other_____

Certified by: _____ Date:_____
Teacher

Cost of Gasoline

(Multiplication)

Auto Math 1

COST OF GASOLINE

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the skills of MULTIPLICATION OF DECIMALS and estimating answers ir the automotive shop.

b. What student learning problem(s) prompted the development of this technique?

Students cannot multiply decimals.

Students are unable to estimate correct answers.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Give your students the worksheet "Cost of Gasoline". They will be asked to figure how much money they will need to spend for a certain amount of gasoline at a given price.

b. Go over the first example with your students stressing how to estimate answers. Some students do not understand where decimal points should be placed. If they learn to estimate answers, they have a better idea where the decimal point belongs.

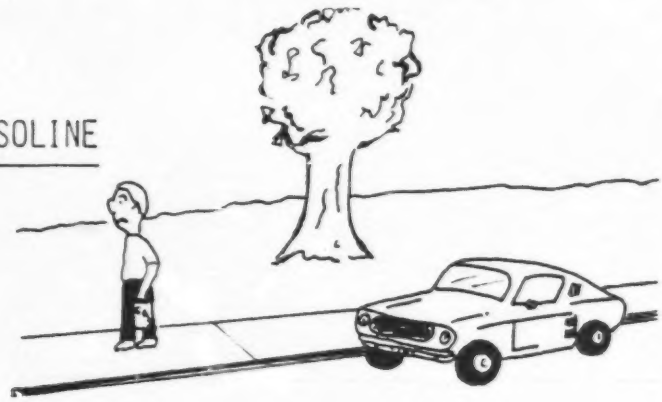
c. Assist them with the second example if they need help.

d. Have your students do the problems.

3. SUGGESTED RELATED ACTIVITIES:

Give your students more of the same type of problems for homework. Ask them to have their parents help them if they need help.

COST OF GASOLINE



STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. You are going to figure out how much money you will be spending to buy a certain amount of gas for your car.

b. First look at the problems and guess what you think might be close to the correct answer. It is important to guess the answer first, this will help you check your own work.

c. Next, work out the problems.

2. STUDENT ASSIGNMENT:

a. Review the examples given below and on STUDENT PAGE 2.

b. Answer all student problems found on STUDENT PAGES 3 ~~& 4~~.

Example 1: You are going on a trip and you need to buy 15.2 gallons of gasoline. If the gasoline sells for $1.15 a gallon how much money will you be spending?

problem:
$1.15
x 15.2 gallons

guess:
$1.00
x 15 gallons
$15.00

answer:
$1.15
x 15.2 gallons
230
5750
11500
$17.480

The answer is $17.48. The guess was $15.00. The problem was worked out correctly.

3. EXTRA THINGS THAT YOU CAN DO:

The next time you are with someone who is buying gas, ask how many gallons of gas they are going to buy. Guess how much they will be spending.

STUDENT PAGE 1

1.2

COST OF GASOLINE

RULE FOR DECIMAL PLACEMENT

1. Count the number of digits (numbers) to the right of the decimal point in both numbers. Add them together.

$1.15	2 digits	
x 15.2	1 digit	3 digits

2. After you have worked the problem, count the same number of digits from the right on your answer (in this example, 3 digits). Now place the decimal point.

$$\begin{array}{r} \$1.15 \\ \times\ 15.2 \\ \hline 230 \\ 5750 \\ 11500 \\ \hline 17.480 \end{array}$$

Decimal point 3 digits from the right.

The answer is $17.48

Example 2: If you are going to buy 15 gallons of gasoline that sells for $1.15 a gallon how much will you be spending?

problem: $1.15 x 15 gallons

guess: $1.00 x 15 gallons = $15.00

answer:

$$\begin{array}{r} \$1.15 \\ \times\ 15 \\ \hline 575 \\ 1150 \\ \hline 1725 \end{array}$$

Where does the decimal point belong?

The answer is $17.25

STUDENT PAGE 2

COST OF GASOLINE

STUDENT PROBLEMS: Find the cost of the gasoline for each of the following problems.

1. Gallons of gas: 9
   Cost per gallon: $1.47

   problem:

   guess:

   answer:

2. Gallons of gas: 17.8
   Cost per gallon: $1.18

   problem:

   guess:

   answer:

3. Gallons of gas: 13.9
   Cost per gallon: $1.06

   problem:

   guess:

   answer:

4. Gallons of gas: 16
   Cost per gallon: $1.48

   problem:

   guess:

   answer:

NUMBER BINGO

(Fractions/Decimals)

Auto Math 2

NUMBER BINGO

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will help students to read common fractions and decimals correctly.

b. What student learning problem(s) prompted the development of this technique?

Students cannot read fractions or decimals.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. This exercise can be used as a warm-up activity to get your students thinking about decimals. For example, it could be used prior to a lesson on reading a micrometer.

b. This technique is a bingo game where you read off a fraction or decimal and your students have to recognize these numbers.

c. Before playing the game discuss briefly with your class 10ths, 100ths and 1000ths and decimal place values (.1, .01, .001.).

d. Explain to your students how to play bingo. Make sure when your students draw a line through the number on their cards that they do not cross out the number completely.

e. Reproduce these sample bingo cards or make your own.

f. Cut up the "numbers to be read off" for easy use in the bingo game.

g. In order to arouse student interest in the game you may want to offer a "prize".

3. SUGGESTED RELATED ACTIVITIES:

Play the game again having a student or students read the numbers. Have your students practice adding decimals they will use when reading a micrometer.

NUMBER BINGO

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. You are going to be playing a bingo game. As your teacher calls off a number find it on your card and draw a line through the number as it is read.

b. Play until you fill up one row or column of numbers.

2. STUDENT ASSIGNMENT:

These are the fractions and decimals that will be read off in the bingo game:

$\frac{1}{10}$	$\frac{53}{1000}$	.57	$\frac{236}{1000}$	1.589
$\frac{3}{10}$	$\frac{21}{1000}$	.095	.93	3.730
$\frac{9}{10}$	.36	.176	.234	9.806
$\frac{1}{100}$	.4	1.57	.456	.02
$\frac{35}{100}$	.7	3.79	.698	.078
$2\frac{129}{1000}$	.39	5.863	.999	.492
.001	.050	.003	2.469	.767

3. EXTRA THINGS THAT YOU CAN DO:

Practice reading a micrometer.

SAMPLE BINGO CARDS

$\frac{1}{10}$	.02	.39	.57	$\frac{35}{100}$
$2\frac{129}{1000}$	.003	.050	.698	.078
.234	3.79	FREE	$\frac{53}{1000}$	$\frac{9}{10}$
.095	9.806	$\frac{1}{100}$	.36	3.730
1.589	.767	.492	$\frac{21}{1000}$	2.469

.698	1.589	$\frac{1}{10}$	.001	.003
.02	$\frac{35}{100}$	.57	.999	$2\frac{129}{1000}$
.7	.93	FREE	$\frac{3}{10}$	.050
$\frac{236}{1000}$	.767	.176	.456	.078
1.57	5.863	$\frac{9}{10}$	3.730	$\frac{1}{100}$

SAMPLE BINGO CARDS

.4	2.469	$\frac{21}{1000}$	1.589	.02
$\frac{236}{1000}$	$\frac{1}{100}$	3.730	.36	.492
.095	.999	FREE	$\frac{9}{10}$	2.469
$\frac{3}{10}$	1.57	9.806	$\frac{53}{1000}$	$2\ \frac{129}{1000}$
3.79	.767	.078	.003	.050

Figuring Gear Ratios

(Ratios)

Auto Math 3

FIGURING GEAR RATIOS

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach students to figure ratios for shop work.

b. What student learning problem(s) prompted the development of this technique?

Students do not understand the concept of ratios.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. This technique can be used to strengthen your students understanding of ring and pinon gear ratios.

b. Your students will be asked to figure gear ratios.

c. There are three different question sections. Explain the examples in one section, have your students answer the questions, then explain the example in the next section, etc.

3. SUGGESTED RELATED ACTIVITIES:

Introduce your students to gear ratios which are in decimal form, example: 3.55:1, 2.7:1.

FIGURING GEAR RATIOS

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. You are going to learn how to figure gear ratios. Remember when you see a gear ratio such as 3:1 that the ring gear is the larger part of the ratio.

b. Study each of the examples and then do the questions.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGE 2-4.

3. EXTRA THINGS THAT YOU CAN DO:

Look in the shop manual for your car and find the number of ring teeth and pinon teeth for your car. Figure the rear axle ratio for your car.

STUDENT PAGE 1

FIGURING GEAR RATIOS

EXAMPLE 1 A typical ring and pinon gear ratio might be a ratio of 3:1. This means that for every one turn on the ring gear the pinon gear turns 3 times. There are three times more teeth on the ring gear than the pinon gear.

QUESTION If there are 33 teeth on the ring gear how many teeth are there on the pinon gear?

The ratio is 3:1 and there are 33 teeth on the ring gear. To find the number of teeth on the pinon gear we have to make two equal fractions.

$$\begin{matrix}\text{numerator} \\ \text{denominator}\end{matrix} \quad \frac{3}{1} = \frac{33}{?} \quad \begin{matrix}\text{teeth ring gear} \\ \text{teeth pinon gear}\end{matrix}$$

Step 1 We have to figure out what number times 3 gives us 33. We have to divide 3 into 33.

$$3\overline{)33} = 11$$

The answer is 11

Step 2 Multiply both the numerator and denominator by this number.

$$\frac{3}{1} \times \frac{11}{11} \times \frac{33}{11} \quad \begin{matrix}\text{teeth ring gear} \\ \text{teeth pinon gear}\end{matrix}$$

ANSWER If there are 33 teeth on the ring gear and the ratio is 3:1, there are 11 teeth on the pinon gear.

STUDENT PROBLEMS Do these problems following the example above.

1. Ratio 4:1
   ring gear 24 teeth
   pinon gear ___ teeth

2. Ratio 4:3
   ring gear 48 teeth
   pinon gear ___ teeth

3. Ratio 3:2
   ring gear 33 teeth
   pinon gear ___ teeth

4. Ratio 2:1
   ring gear 16 teeth
   pinon gear ___ teeth

FIGURING GEAR RATIOS

EXAMPLE 2

QUESTION

If the ratio is 3:2 and there are 18 teeth on the pinon gear how many teeth are there on the ring gear?

The ratio is 3:2 and there are 18 teeth on the pinon gear. We have to make two equal fractions.

numerator $\frac{3}{2} = \frac{?}{18}$ teeth ring gear
denominator teeth pinon gear

Step 1 We have to figure out what number times 2 gives us 18. We have to divide 2 into 18.

$$2\overline{)18}^{\,9}$$
$$\underline{18}$$

The answer is 9

Step 2 Multiply both the numerator and denominator by this number.

$$\frac{3}{2} \times \frac{9}{9} = \frac{27}{18}$$ teeth ring gear
teeth pinon gear

ANSWER

If there are 18 teeth on the pinon gear and the ratio is 3:2, there are 27 teeth on the ring gear.

STUDENT PROBLEMS Do these problems following the example above.

1. Ratio 3:1
   ring gear ___ teeth
   pinon gear 12 teeth

2. Ratio 5:2
   ring gear ___ teeth
   pinon gear 10 teeth

3. Ratio 3:2
   ring gear ___ teeth
   pinon gear 12 teeth

4. Ratio 4:1
   ring gear ___ teeth
   pinon gear 5 teeth

STUDENT PAGE 3

FIGURING GEAR RATIOS

EXAMPLE 3

QUESTION If you know the number of teeth on ring and pinon gears how can you determine the ratio? We have 25 teeth on the ring gear and 10 teeth on the pinon gear.

numerator
denominator $\frac{25}{10} \div \frac{?}{?} = \frac{?}{?}$ (ratio)

Step 1 We have to simplify this fraction to lowest terms. We do this by finding the largest number we can divide into <u>both</u> <u>numerator</u> and <u>denominator</u> evenly.

$$5\overline{)10}\ 2 \qquad 5\overline{)25}\ 5$$

Step 2 Divide <u>both</u> the <u>numerator</u> and <u>denominator</u> by this number.

$$\frac{25}{10} \div \frac{5}{5} = \frac{5}{2}$$

ANSWER If there are 25 teeth on the ring gear and 10 teeth on the pinon gear the ratio is 5:2.

<u>STUDENT PROBLEMS</u> Do these problems following the example above.

1. Ratio:_____
   ring gear <u>15 teeth</u>
   pinon gear <u>10 teeth</u>

2. Ratio:_____
   ring gear <u>18 teeth</u>
   pinon gear <u>6 teeth</u>

3. Ratio: _____
   ring gear <u>16 teeth</u>
   pinon gear <u>8 teeth</u>

4. Ratio: _____
   ring gear <u>48 teeth</u>
   pinon gear <u>12 teeth</u>

5. Ratio: _____
   ring gear <u>25 teeth</u>
   pinon gear <u>5 teeth</u>

Checking the Float Level on a Carburetor

(Fractions)

Auto Math 4

CHECKING THE FLOAT LEVEL ON A CARBURETOR

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

Reading a float gauge and understanding fractional equivalents

b. What student learning problem(s) prompted the development of this technique?

Students do not know how to read float gauges.

Students do not understand fractional equivalents.

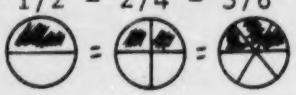
2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. This is an exercise to help your students learn to read a float gauge. Since the settings for the carburetor float are not always expressed in 32nd of an inch, your students will be shown how to convert other fractions to 32nd inch denominators.

b. Read over and explain the worksheet to your students and then let your class answer the questions.

c. Your students will be taught about numerators and denominators $\left(\frac{1}{2}\ \begin{matrix}\text{numerator}\\ \text{denominator}\end{matrix}\right)$ and how to convert fractions to higher equivalences.

d. If your students have problems understanding fractional equivalents use this illustration: 1/2 = 2/4 = 3/6



3. SUGGESTED RELATED ACTIVITIES:

Encourage your students to devise a float level demonstration for competition in the VICA Skills Olympics.

CHECKING THE FLOAT LEVEL ON A CARBURETOR

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. In order to be able to check the float level on a carburetor you have to know how to read a float gauge.

b. Read the information on STUDENT PAGE 2 and then answer the questions.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2-3.

3. EXTRA THINGS THAT YOU CAN DO:

Demonstrate to the class how to set the float level on a carburetor and how to read a float level gauge.

STUDENT PAGE 1

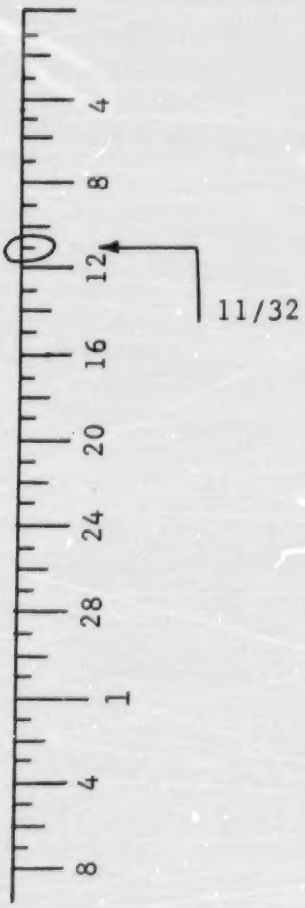
CHECKING THE FLOAT LEVEL ON A CARBURETOR

THE FLOAT GAUGE: The float gauge is marked in 32nd of an inch. Each mark on the gauge stands for 1/32nd of an inch, 32 marks = 1 inch.

To make reading the gauge easier, 4/32 is marked with the number 4, 8/32 with an 8, 12/32 with a 12, 16/32 with a 16, 20/32 with a 20, 24/32 with 24 and 28/32 with a 28.

READING THE FLOAT GAUGE: If the setting on a carburetor float is for 11/32nd of an inch, the setting would be the mark above 12/32 on the gauge. SEE THE GAUGE BELOW.

QUESTION: Find 1 3/32nd of an inch, Hint: the large numbers 1, 2, 3, 4 and 5 stand for 1 inch, 2 inch, 3 inch, etc. SEE GAUGE BELOW.



STUDENT PAGE 2

CHECKING THE FLOAT LEVEL ON A CARBURETOR

FRACTIONAL EQUIVALENTS

QUESTION: How would you find a reading of 7/16 on a gauge which is marked in 32nd of an inch?

If you have to change the setting on a carburetor float and the fraction is not in 32nd of an inch, change it to 32nds of an inch.

$\frac{7}{16}$ numerator
denominator

STEP 1 Figure out what number times the denominator will give you 32. On this example it is 2.

STEP 2 Multiply both the numerator and denominator by this number.

$$\frac{7}{16} \times \frac{2}{2} = \frac{14}{32}$$

These fractions are now equal.

$$\frac{7}{16} = \frac{14}{32}$$

Because these fractions are equal you can now make a 7/16 setting on a 32nd inch gauge. You would set the gauge at 14/32.

STUDENT PROBLEMS These are possible settings for carburetor floats. The fractions are not in 32nds of an inch and you would be using a 32nd inch float gauge. Change these fractions to 32nd of an inch. SEE THE EXAMPLE BELOW. (" = inch)

Example: $\frac{3"}{8} \times \frac{4}{4} = \frac{12"}{32}$ $\qquad$ $\frac{1"}{2} \times \frac{\quad}{\quad} = \frac{\quad"}{\quad}$

$\frac{3"}{16} \times \frac{\quad}{\quad} = \frac{\quad"}{32}$ $\qquad$ $\frac{5"}{8} \times \frac{\quad}{\quad} = \frac{\quad"}{\quad}$

$\frac{7"}{8} \times \frac{\quad}{\quad} = \frac{\quad"}{\quad}$ $\qquad$ $\frac{9"}{16} \times \frac{\quad}{\quad} = \frac{\quad"}{\quad}$

$\frac{1"}{4} \times \frac{\quad}{\quad} = \frac{\quad"}{\quad}$ $\qquad$ $\frac{3"}{8} \times \frac{\quad}{\quad} = \frac{\quad"}{\quad}$

$\frac{3"}{4} \times \frac{\quad}{\quad} = \frac{\quad"}{\quad}$ $\qquad$ $\frac{1"}{16} \times \frac{\quad}{\quad} = \frac{\quad"}{\quad}$

Changing the Float Level on a Carburetor

(Fractions)

Auto Math 5

CHANGING THE FLOAT LEVEL ON A CARBURETOR

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach adding and subtracting like and unlike fractions.

b. What student learning problem(s) prompted the development of this technique?

Students cannot add or subtract like and unlike fractions.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. This technique should be used after your students have completed the lesson "Checking the Float Level on a Carburetor."

b. This is an exercise to teach your students how to add and subtract like and unlike fractions. Many students will not understand fractions. It is recommended that you review the attached Lesson on Fractions with your students prior to having them do the worksheet "Changing the Float Level on a Carburetor."

c. Read and discuss the worksheet with your class.

d. Have your students answer the questions.

3. SUGGESTED RELATED ACTIVITIES

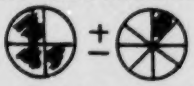
Encourage your students to devise a float level demonstration for competition in the VICA Skills Olympics.

LESSON ON FRACTIONS

To help students understand adding and subtracting like fractions...

1. Draw this on the board
2. Explain that 3/4 is shaded
3. Erase one section to get 2/4
4. Add one section to 3/4 to get 4/4

To help students understand adding and subtracting unlike fractions...

1. Draw this on the board 
2. You are going to show your students how to add or subtract 1/8 to 3/4. <u>Since you cannot add or subtract unlike fractions</u>, the 3/4 has to be changed to 6/8. Do this for your students to see.
3. Now add and subtract 1/8 to get 5/8 and 7/8.
4. Explain to your students that you cannot add and subtract unlike fractions. The fractions have to be made into like fractions. It is not uncommon for students to add...

$$\begin{array}{r} \frac{3}{4} \\ +\ \frac{1}{8} \\ \hline \end{array}$$

and get $\frac{4}{12}$!!!

CHANGING THE FLOAT LEVEL ON A CARBURETOR

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. In order to change the float level on a carburetor, you have to know how to add and subtract like and unlike fractions.

b. Read the information on STUDENT PAGES 2 & 3 and answer the questions.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 AND 3.

3. EXTRA THINGS THAT YOU CAN DO:

Demonstrate to the class how to set the float level on a carburetor and how to read a float gauge.

STUDENT PAGE 1

CHANGING THE FLOAT LEVEL ON A CARBURETOR

Example 1: If the float level is set at 9/32 of an inch and you need to change the setting by subtracting 2/32 of an inch, how is this done?

9 numerator
32 denominator

$$\frac{9}{32}$$

Subtract the numerators and bring down the denominators

$$-\frac{2}{32}$$

$$\frac{7}{32}$$

Example 2: If the float level is set at 11/32 of an inch and you need to change it by adding 1/8 inch, how is this done?

The float gauge is marked in 32nds of an inch. You cannot add 1/8 inch to 32nd of an inch. You are dealing with unlike fractions. You have to make the fractions like fractions.

To add 1/8 inch to 11/32 inch you have to change the 1/8 inch to 32nds of an inch.

$$\frac{11}{32}$$

$$+\frac{1}{8}$$

Step 1 Change 1/8 to 32nds. Figure out what number times the denominator 8 will give you 32. On this example it is 4.

Step 2 Multiply both the numerator and denominator by this number.

$$\frac{1}{8} \times \frac{4}{4} = \frac{4}{32}$$

These fractions are now equal.

$$\frac{1}{8} = \frac{4}{32}$$

Now you can add these fractions ...

STUDENT PAGE 2

CHANGING THE FLOAT LEVEL ON A CARBURETOR

$$\begin{array}{r} \frac{11}{32} \\ +\ \frac{4}{32} \\ \hline \frac{15}{32} \end{array}$$

(Add the numerators, 11 and 4, to get 15.)

11/32 added to 1/8 equals <u>15/32</u>.

STUDENT PROBLEMS These are possible changes in carburetor float settings. Some fractions are not in 32nds of an inch. Change all fractions to 32nds of an inch and then <u>add</u> or <u>subtract</u>.

1.) $\frac{3}{16} + \frac{7}{32}$

2.) $\frac{7}{16} - \frac{1}{32}$

3.) $\frac{5}{8} - \frac{1}{32}$

4.) $\frac{11}{32} - \frac{1}{4}$

5.) $\frac{1}{16} + \frac{2}{32}$

6.) $\frac{1}{4} + \frac{5}{32}$

Gas Mileage

(Division)

Auto Math 6

GAS MILEAGE

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the skills of MULTIPLICATION and DIVISION of whole numbers and estimating answers in the automotive shop.

b. What student learning problem(s) prompted the development of this technique?

1. Students cannot multiply or divide whole numbers.
2. Students are unable to estimate the correct answers.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

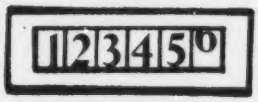
a. Give your students the worksheet "GAS MILEAGE". They will be asked to compute the amount of gasoline required for a trip. They will also be asked to figure the number of miles they can travel if they have a certain amount of gas and their car averages a certain number of miles per gallon.

b. Work out the examples with your students stressing how to estimate answers. This will help your students to correct their own answers.

3. SUGGESTED RELATED ACTIVITIES:

Give your students more of the same type of problems for homework. Ask them to have their parents help them with these problems.

GAS MILEAGE



STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. You are going to be figuring out 1) the number of gallons of gasoline required for a trip and 2) the number of miles you can travel if your car has a certain amount of gas in the tank.

b. First look at the examples and estimate what you think might be close to the correct answer. It is important to estimate the answer first; this will help you check your own work.

c. Next work out the problems.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2, 3, 4 AND 5.

3. EXTRA THINGS THAT YOU CAN DO:

The next time you go on a car trip and you know how many miles you will be traveling, guess how much gas you will need for the trip.

STUDENT PAGE 1

GAS MILEAGE

Example 1: You are going to drive from Los Angeles to Las Vegas. The number of miles between these two cities is 276 miles. If your car averages 12 miles per gallon, how many gallons of gas will you need for the trip?

problem: 12 gal)276 miles

guess: 10 gal)250 miles
25 gal

answer: 12 gal)276 miles
23 gal
24
36
36
0

The answer is 23 gallons. The guess was 25 gallons. The problem was worked out correctly.

STUDENT PROBLEMS: Work these problems following the example above.

1. miles driven: 204

   miles per gallon: 17

   problem:

   guess:

   answer:

2. miles driven: 253

   miles per gallon: 23

   problem:

   guess:

   answer:

GAS MILEAGE

Work these problems following the example shown on STUDENT PAGE 2.

3. miles driven: 209

   miles per gallon: 19

   problem:

   guess:

   answer:

4. miles driven: 608

   miles per gallon: 32

   problem:

   guess:

   answer:

5. miles driven: 780

   miles per gallon: 39

   problem:

   guess:

   answer:

STUDENT PAGE 3

GAS MILEAGE

Example 2: You have 5 gallons of gas in your car. If your car averages 21 miles per gallon, how many miles can you travel?

problem:
21 miles per gallon
x 5 gallons

guess:
20 miles per gallon
x 5 gallons
100 miles

answer:
21 miles per gallon
x 5 gallons
105 miles

The answer is 105 miles. The guess was 100 miles. The problem was worked out correctly.

STUDENT PROBLEMS: Work these problems following the example above.

1. gallons of gas: 12

   miles per gallon: 17

   problem:

   guess:

   answer:

2. gallons of gas: 5

   miles per gallon: 19

   problem:

   guess:

   answer:

STUDENT PAGE 4

GAS MILEAGE

Work these problems following the example shown on STUDENT PAGE 4.

3. gallons of gas: 9

   miles per gallon: 32

   problem:

   guess:

   answer:

4. gallons of gas: 11

   miles per gallon: 14

   problem:

   guess:

   answer:

5. gallons of gas: 21

   miles per gallon: 23

   problem:

   guess:

   answer:

STUDENT PAGE 5

The Micrometer - A Valuable Measuring Tool

(Decimals)

Auto Math 7

THE MICROMETER

A VALUABLE MEASURING TOOL

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

   a. What SKILL will this technique teach?

      This technique will teach DECIMALS; it is also a good aid for teaching the micrometer.

   b. What student learning problem(s) prompted the development of this technique?

      Students very often are unable to read a micrometer because they are unsure of how to add and subtract decimals.

      This technique was developed as a PARENT INVOLVEMENT technique.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

   a. Make your regular presentation to the class describing the use of the micrometer.

   b. For those students who have difficulty reading the micrometer, you may now wish to assign them this Parent Involvement worksheet for use in the home.

   c. Part of this assignment requires that the student have one of his/her parents sign the last page of the assignment indicating that they have helped their son/daughter learn to read a micrometer. You may wish to give this student extra credit for this work, after you are assured that they can now read the micrometer.

3. SUGGESTED RELATED ACTIVITIES:

   You may wish to develop other techniques where the parent plays an active role in the instruction of their son/daughter.

THE MICROMETER

A Valuable Measuring Tool

Student Materials:

1. Student INSTRUCTIONS:

a. Take this MICROMETER assignment home and ask one of your parents to help you learn to read the micrometer.

b. When you are finished answering the two questions on the last page of this assignment, ask one of your parents to sign this sheet, showing that they have helped you learn how to read the micrometer.

2. THE MICROMETER - A Valuable Measuring Tool

The micrometer assignment sheets are found on Student Pages 2-5.

3. Extra Things That You Can Do:

You will be surprised how many different things that your parents are able to help you learn about. Maybe they can help you figure out why that engine you may be working on will not start.

THE MICROMETER

A VALUABLE MEASURING TOOL

PARENTS & GUARDIANS:

Your son or daughter is now learning the use of the micrometer as part of the instruction in the industrial arts program in high school. In order to reinforce the instruction that the teacher gives, we would like for you to take a few minutes and review the use of the micrometer with your son or daughter.

The micrometer is a measuring tool used to measure the diameter or thickness of an object. This object is normally metal or plastic; wood is not measured with a micrometer because it is a relatively soft material.

Micrometers range in size from a ONE INCH (1") micrometer up to a micrometer so large a crane is required to operate it. Micrometers are named according to the limits of their measurement capability. For example:

A micrometer that measures from:

0" to 1" is called a ONE INCH MICROMETER

1" to 2" is called a TWO INCH MICROMETER

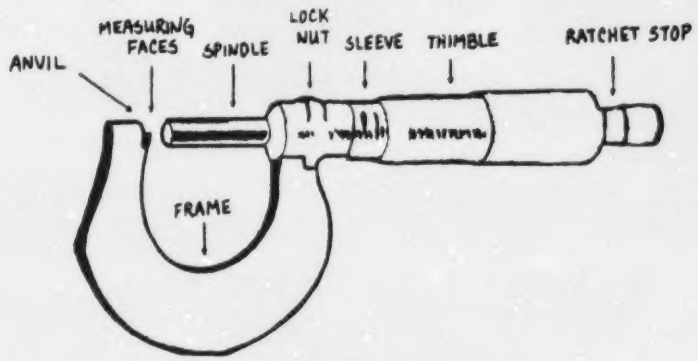
2" to 3" is called a THREE INCH MICROMETER

Micrometer sizes increase by 1 inch divisions (increments).

NO MATTER WHAT SIZE MICROMETER YOU ARE WORKING WITH, ALL MICROMETERS

READ THE SAME

Each part of the micrometer has a name. The micrometer below has all of its parts labeled:

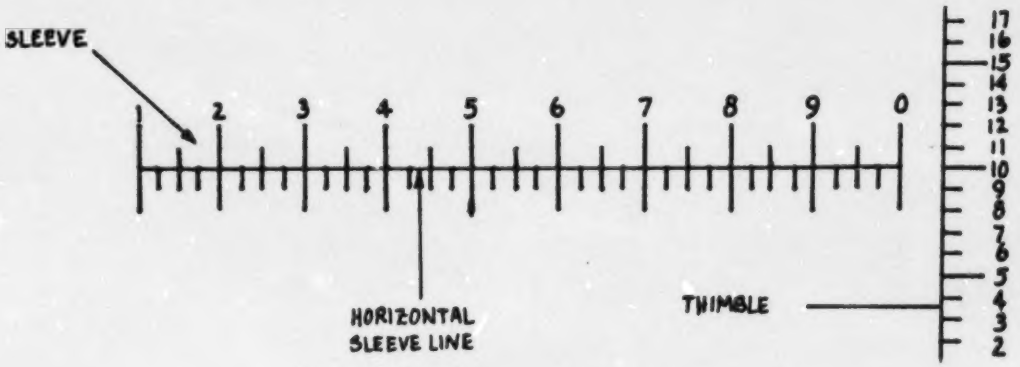


STUDENT PAGE 2

THE MICROMETER

A VALUABLE MEASURING TOOL

An enlarged view of the micrometer sleeve and thimble are pictured below:



Directions for use of the micrometer:

STEP 1: The part to be measured is placed between the measuring faces of the micrometer. The thimble of the micrometer is turned clockwise until the part is held firmly in the micrometer.

STEP 2: The micrometer is read at the sleeve and thimble as pictured above. Each and every line on the sleeve represents .025 of an inch. Therefore, the number 1 indicates .100 of an inch, the number 2 indicates .200 of an inch, the number 3 indicates .300 of an inch and so on. The number 0 at the end of the micrometer sleeve indicates 1.000 inch.

The numbers 1 through 24 on the micrometer thimble represent .001 of an inch.

When reading the micrometer sleeve, only those numbers and marks which are completely visible to the left of the thimble are to be read.

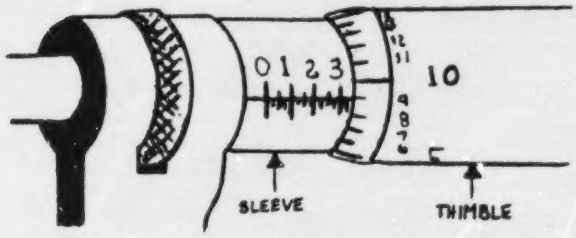
Only the number on the thimble which aligns with the horizontal sleeve line should be read.

STUDENT PAGE 3

THE MICROMETER

A VALUABLE MEASURING TOOL

STEP 3: You are now ready to read the micrometer. The micrometer reading below shows the number 3 and one mark past the 3 completely visible to the left of the micrometer thimble. This reading indicates .325 of an inch. Added to this should be .009 of an inch represented by the number on the thimble which is aligned with the horizontal sleeve line. Therefore, by simple addition of .325 and .009, the total micrometer reading is .334 of an inch.



$$\begin{array}{r} .325 \\ +\ .009 \\ \hline .334 \end{array}$$

STEP 4: If the micrometer pictured above were a ONE INCH micrometer, the total reading would be .334 of an inch. However, if the micrometer were a 2 inch micrometer, the reading would be 1.334 inches. If the micrometer were a 3 inch micrometer, the reading would then be 2.334 inches.

REMEMBER, if the micrometer is larger than a 1 inch micrometer, the next smaller number must be placed in front of the decimal point when recording the measurement.

EXAMPLE:

A 1 inch micrometer measures from 0 to 1 inch, therefore the reading would simply be .334 inch.

A 2 inch micrometer measures from 1 to 2 inches, therefore the reading would be 1.334 inches.

A 3 inch micrometer measures from 2 to 3 inches, therefore the reading would be 2.334 inches.

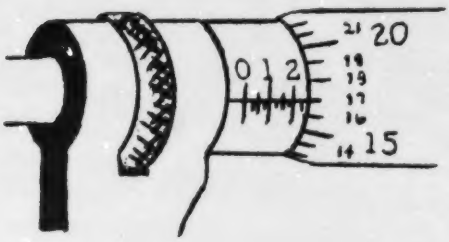
A 7 inch micrometer measures from 6 to 7 inches, therefore the reading would be 6.334 inches.

STUDENT PAGE 4

THE MICROMETER

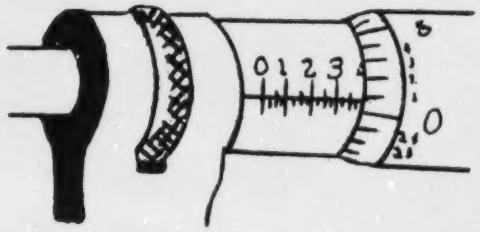
A VALUABLE MEASURING TOOL

Write down the correct readings for the micrometers below:



a. This is a 5 inch micrometer

a._____



b. This is a 2 inch micrometer

b._____

Please have one of your parents or guardians sign this sheet in order to show that they have helped you with this assignment.

_____ _____

Signature Date

STUDENT PAGE 5

MEASUREMENTS

(Reading A Ruler)

Auto Math 8

MEASUREMENTS

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach students how to read a ruler.

b. What student learning problem(s) prompted the development of this technique?

Students cannot read a ruler or toe gauge.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. This is a lesson to help your students learn to read a ruler or toe gauge.

b. Read and discuss the technique with your students and then have them answer the questions.

c. If your students have problems doing this technique you may find it necessary to teach them to simplify fractions. They can always count the marks on a ruler and come up with a fraction like 8/16ths. Tell them to take 8/16 and find the largest whole number that they can divide into the numerator and denominator evenly.

example: $\frac{8}{16} \div \frac{8}{8} = \frac{1}{2}$

Emphasize to your students that where they are simplifying fractions to divide both the numerator and denominator by the same number. Students try to divide one number into the numerator and another number into the denominator.

example: $\frac{8}{16} \div \frac{2}{8} = \frac{4}{2}$ THIS IS WRONG

3. SUGGESTED RELATED ACTIVITIES:

Have your students measure the inside diameter of a brake drum.

MEASUREMENTS

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. You use rulers or gauges in many different ways when working on a car; for example, adjusting fan belts and measuring wheel base.

b. This lesson will help you learn to read rulers and gauges.

c. Read the information and answer the questions.

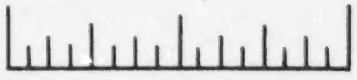
2. STUDENT ASSIGNMENT:

Your assignment is found below and on STUDENT PAGES 2 AND 3.

READING A RULER

A ruler is made up of a series of marks that stand for parts of an inch (fractions) and inches. Most rulers are marked in 16ths of an inch. Each mark represents 1/16th of an inch. 16/16ths = 1 inch.

This ruler is in 16ths:

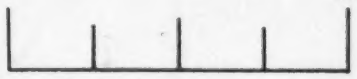


$\frac{16}{16}$ = 1 inch

This ruler is in 8ths:

$\frac{8}{8}$ = 1 inch

This ruler is in 4ths:



$\frac{4}{4}$ = 1 inch

The large numbers on the ruler or gauge stand for 1, 2, 3 inches etc.

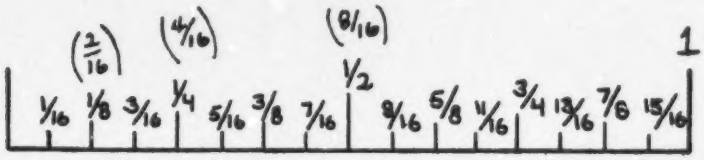
3. EXTRA THINGS THAT YOU CAN DO:

Measure the wheelbase on a car.

MEASUREMENTS

Notice below that there are different sizes of marks on a ruler.

1. The smallest marks are 16ths of an inch: 1/16
2. The next largest marks are 8ths of an inch: 1/8
3. The next largest marks are 4ths of an inch: 1/4
4. The next largest mark is a half of an inch: 1/2
5. The largest marks are inches: 1,2,3, etc.

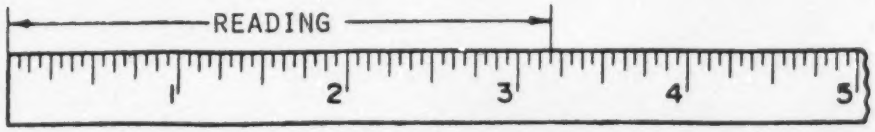


A mark can be called by more than one fractional name. For example 1/2 is also 8/16; 1/4 is also 4/16; and 1/8 is also 2/16; but when you read a ruler you always read the fraction with the smallest denominator.

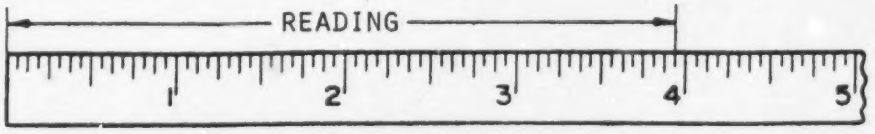
$\frac{1}{2}$ ← The denominator is the lower number on the fraction.

STUDENT PROBLEMS:

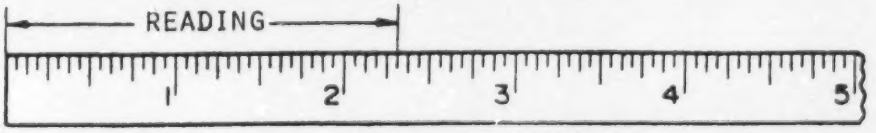
1. Write the correct measurement on the blanks to the right of each question.

a. 

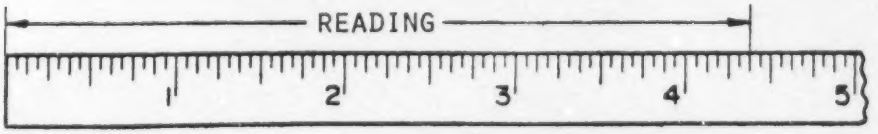
a. _____

b. 

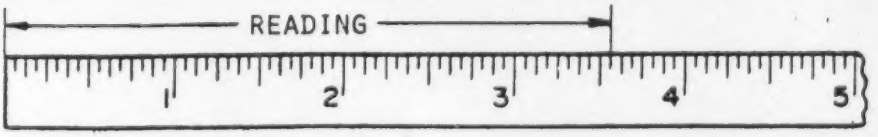
b. _____

c. 

c. _____

d. 

d. _____

e. 

e. _____

8.3

2. You simplify fractions by finding the largest number you can divide into both the numerator and denominator.

Example: $\frac{12}{18} \div ? = \frac{?}{?}$

$\frac{12}{18} \div ? = \frac{?}{?}$

You can divide both the 12 and 18 by 3 and 6. Since 6 is the largest number use it.

$$\frac{12}{18} \div 6 = \frac{2}{3}$$

Simplify these fractions:

$\frac{10}{16} =$ $\frac{18}{32} =$ $\frac{5}{10} =$

$\frac{4}{8} =$ $\frac{4}{32} =$ $\frac{10}{15} =$

$\frac{6}{16} =$ $\frac{4}{16} =$ $\frac{25}{30} =$

$\frac{8}{16} =$ $\frac{8}{32} =$ $\frac{8}{24} =$

$\frac{12}{16} =$ $\frac{14}{16} =$ $\frac{15}{18} =$

$\frac{6}{8} =$

THE FOLLOWING INDUSTRIAL EDUCATION BASIC SKILL INSTRUCTIONAL TECHNIQUES ARE AVAILABLE FROM:

VOICE (VOCATIONAL OCCUPATIONAL INFORMATION CENTER FOR EDUCATORS)
721 CAPITOL MALL
SACRAMENTO, CALIFORNIA 95814

"LEARNING TO READ AND WRITE THE AUTOMOTIVE WAY"
"LEARNING TO DO MATH THE AUTOMOTIVE WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE AUTOMOTIVE WAY"

"LEARNING TO READ AND WRITE THE WOODWORKING WAY"
"LEARNING TO DO MATH THE WOODWORKING WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE WOODWORKING WAY"

"LEARNING TO READ AND WRITE THE METALWORKING WAY"
"LEARNING TO DO MATH THE METALWORKING WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE METALWORKING WAY"

"LEARNING TO READ AND WRITE THE ELECTRONICS WAY"
"LEARNING TO DO MATH THE ELECTRONICS WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE ELECTRONICS WAY"

"LEARNING TO READ AND WRITE THE DRAFTING WAY"
"LEARNING TO DO MATH THE DRAFTING WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE DRAFTING WAY"